Subsolidus formation and impedance spectroscopy studies of materials in the (Bi2O3)1−x (Y2O3)x binary system.

Abstract

Single phase (Bi2O3)1−x(Y2O3)x samples with x = 0.15, 0.20, 0.30 and 0.40 were successfully synthesised via conventional solid state method at the firing temperature of 800 °C over 24 h. These samples crystallised in cubic fluorite structure, space group, Fm-3m and lattice parameters, a ranging from 5.5167 Å to 5.4369 Å with an increase of doped Y2O3. The linear-plot obeyed Vegard's law, revealing a well-behaved substitutional solid solution existed within the incorporated dopant concentration range. (Bi2O3)1−x(Y2O3)x subsolidus system was thermally stable as no phase transition or weight loss was discernable within the studied temperature. The electrical properties of the prepared samples were characterised by AC impedance analyser, HP4192 at temperature ranging from 25 °C to 850 °C in the frequency range of 5 Hz to 13 MHz. The impedance data could be represented by different RC equivalent circuits. The conduction mechanism involved two processes with different activation energies at low and high temperature regions, e.g. 1.09–1.12 eV and 0.41–0.44 eV, respectively. The ionic conductivities of the prepared samples were found decreased with increase of yttrium content. These values were in general higher than that of commercial yttria- stabilised zirconia (YSZ) solid electrolyte over wide range of temperatures.

Keyword: AC impedance spectroscopy; Solid electrolyte; Subsolidus and fluorite.